

We Claim:

1. A method of preparing a photothermographic emulsion comprising:

5 (A) providing a photothermographic dispersion of a preformed photosensitive silver halide and a non-photosensitive source of reducible silver ions, and performing the following steps (B-1) and (B-2) but not step (C) in either order or at the same time,

10 (B-1) providing an organic sulfur-containing compound in association with said preformed silver halide grains and said non-photosensitive source of reducible silver ions,

(B-2) converting some of the reducible silver ions in said non-photosensitive source of reducible silver ions into photosensitive silver halide grains, and then

15 (C) chemically sensitizing at least said preformed silver halide grains by decomposing said organic sulfur-containing compound on or around said silver halide grains in an oxidizing environment to provide a photothermographic emulsion comprising sulfur chemically sensitized photosensitive silver halide grains in reactive association with said non-photosensitive source of reducible

20 silver ions.

25 2. The method of claim 1 further comprising mixing said photothermographic emulsion with a binder and coating the resulting photothermographic emulsion formulation onto a support.

3. The method of claim 1 wherein said non-photosensitive

source of reducible silver ions is a silver fatty acid carboxylate having 10 to 30 carbon atoms in the fatty acid or a mixture of said silver fatty acid carboxylates, as least one of which carboxylates is silver behenate.

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4. The method of claim 1 wherein said organic sulfur-containing compound is a sulfur-containing spectral sensitizing dye comprising a ring structure having a thio, thiocarbonyl, or carbonyl group within said ring structure.

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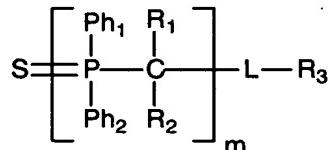
5. The method of claim 4 wherein said organic sulfur-containing compound contains a thiohydantoin, rhodanine, or 2-thio-4-oxo-oxazolidine nucleus, or any combination thereof.

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6. The method of claim 1 wherein said organic sulfur-containing compound is a diphenylphosphine sulfide.

7. The method of claim 6 wherein said organic sulfur-containing compound is represented by the following Structure PS:

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(PS)

wherein Ph_1 and Ph_2 are the same or different phenyl groups, R_1 and R_2 independently represent hydrogen, or a alkyl or phenyl group,, L is a direct bond or a linking group, m is 1 or 2 and when m is 1, R_3 is a monovalent group, and when m is 2, R_3 is a divalent aliphatic linking group having 1 to 20 carbon, nitrogen, oxygen, or sulfur atoms in the chain.

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8. The method of claim 7 wherein R_1 and R_2 are both hydrogen or one of them is methyl, L is a direct bond or sulfonyl or carbonyl linking group, m is 1, and R_3 is an alkyl, aryl, or dialkylamino group.

9. The method of claim 1 wherein said organic sulfur-containing compound is provided in an amount of from about 10^{-6} to about 10^{-1} mol/mol of total silver from the non-photosensitive source of reducible silver ions in said photothermographic dispersion.

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10. The method of claim 1 wherein said reducible silver ions are converted to photosensitive silver halide by one or more additions of a halogen-containing compound in an amount of from about 10^{-4} to about 10^{-1} mol of halogen atom per mol of reducible silver ions.

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11. The method of claim 1 wherein said organic sulfur-containing compound is decomposed by the presence of a hydrobromic acid salt of an N-heterocyclic compound that is associated with a pair of bromine atoms.

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12. The method of claim 1 wherein said organic sulfur-containing compound is decomposed by the portioned addition of an oxidizing agent.

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13. The method of claim 1 wherein said chemical sensitizing step is carried out at a temperature of from about 10°C to about 30°C for up to 60 minutes.

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14. The method of claim 1 further comprising, after said chemical sensitizing step, adding a spectral sensitizing dye to spectrally sensitize said photosensitive silver halide grains to from about 600 nm to about 1100 nm.

15. The method of claim 1 further comprising adding a reducing agent composition to said photothermographic emulsion.

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16. The method of claim 1 further comprising adding a phosphor to said photothermographic emulsion.

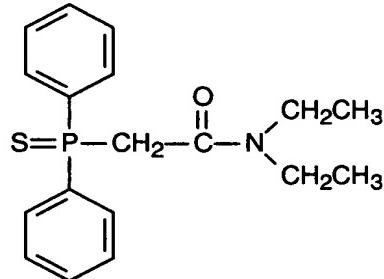
17. A method of preparing a black-and-white photothermographic emulsion comprising:

(A) providing a photothermographic dispersion of a preformed photosensitive silver halide and a non-photosensitive source of reducible silver ions, and performing the following steps in order:

(B-1) providing an organic sulfur-containing compound in association with said preformed silver halide grains and said non-photosensitive source of reducible silver ions, said organic sulfur-containing compound selected from one of the two following groups of compounds:

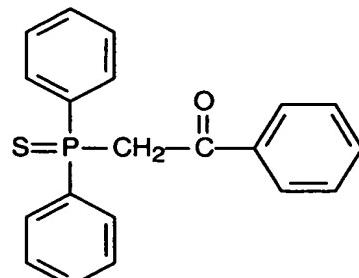
- a. one or more sulfur-containing spectral sensitizing dyes containing a rhodanine nucleus, and
b. one or more of the following diphenylphosphine sulfide compounds PS-1 to PS-19:

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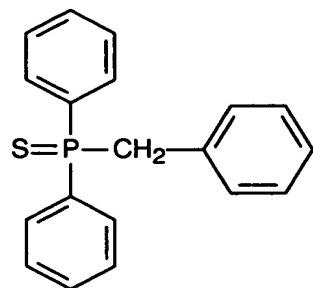


(PS-1)

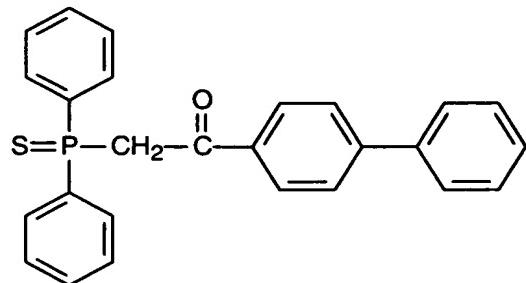
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(PS-2)

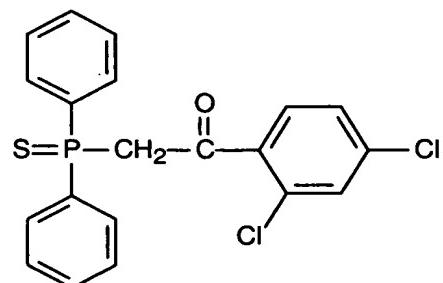


(PS-3)



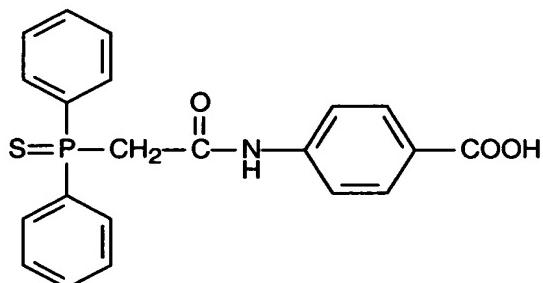
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(PS-4)



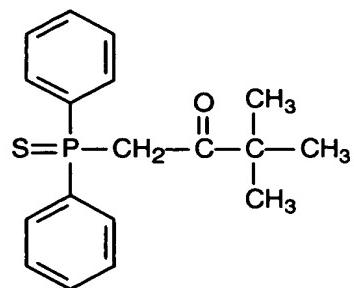
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(PS-5)

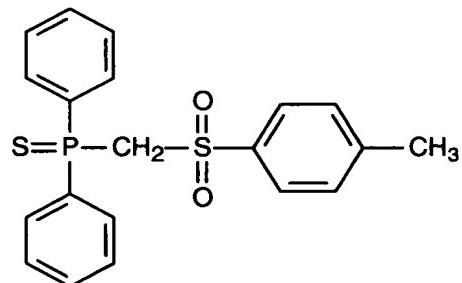


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(PS-6)

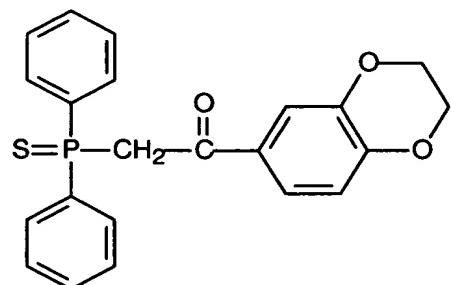


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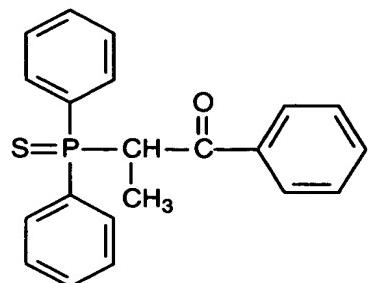
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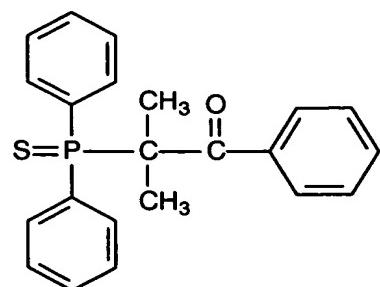
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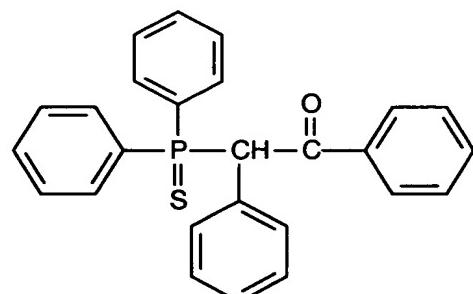


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(PS-10)

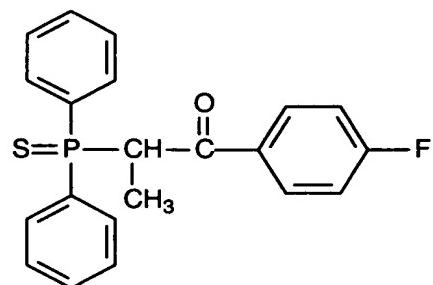


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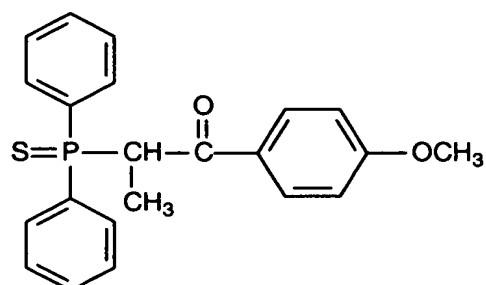
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(PS-12)



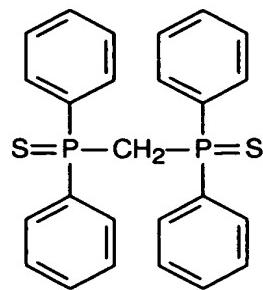
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(PS-13)



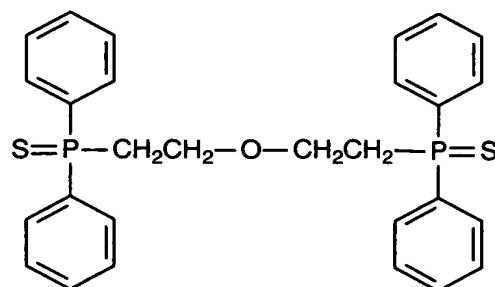
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(PS-14)



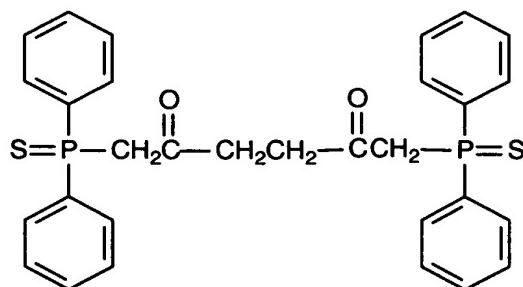
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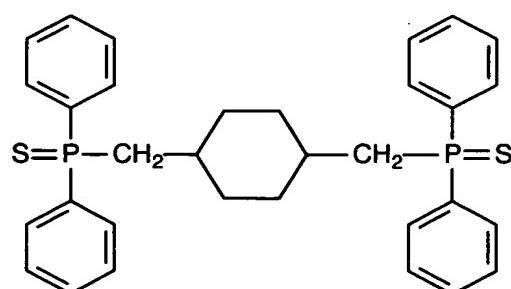
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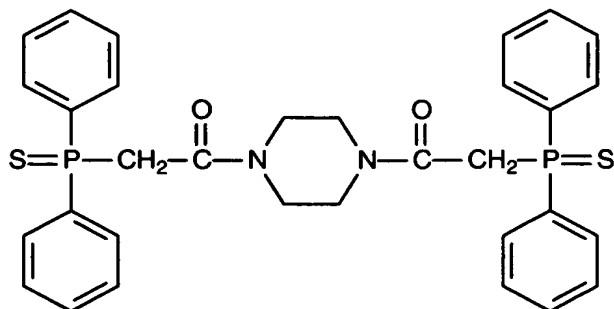


(PS-17)

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(PS-18)



(PS-19),

5 (B-2) converting from about 0.1 to about 10 mol % of the reducible silver ions in said non-photosensitive source of reducible silver ions into photosensitive silver bromide grains by addition of a bromide salt, and then

10 (C) chemically sensitizing at least said preformed silver halide grains by decomposing said organic sulfur-containing compound on or around said silver halide grains by the addition, in one or more stages, of pyridinium hydrobromide perbromide to the silver halide grains at from about 20°C to about 30°C for up to 60 minutes, to provide a photothermographic emulsion comprising chemically sensitized photosensitive silver bromide grains in reactive association with said non-photosensitive source of reducible silver ions comprising silver behenate.

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18. The method of claim 17 further comprising the addition to said photothermographic emulsion of a spectral sensitizing dye to spectrally sensitize said photosensitive silver bromide grains to from about 600 nm to about 1100 nm.

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19. The method of claim 17 further comprising the addition of one or more antifoggants, antistatic agents, toners, matting agents, development accelerators, acutance dyes, post-processing stabilizers or stabilizer precursors, thermal solvents, shelf-life enhancing agents, co-developers, contrast enhancing agents, or high-contrast agents to said photothermographic emulsion.

20. The method of claim 17 further comprising adding a phosphor to said photothermographic emulsion.

21. The method of claim 18 further comprising the addition of a 5 hydrophobic binder to said photothermographic emulsion to provide a photothermographic emulsion formulation.

22. The method of claim 22 further comprising coating said photothermographic emulsion formulation on a support.

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23. A method of preparing a photothermographic material comprising:

(A) providing a photothermographic dispersion of a preformed photosensitive silver halide and a non-photosensitive source of reducible silver ions, and performing steps (B-1) and (B-2) but not step (C) in either order or at the same time,

(B-1) providing an organic sulfur-containing compound in association with said preformed silver halide and said non-photosensitive source of reducible silver ions,

20 (B-2) converting some of the reducible silver ions in said non-photosensitive source of reducible silver ions into photosensitive silver halide grains,

and then

(C) chemically sensitizing at least said silver halide grains by 25 decomposing said organic sulfur-containing compound on or around said silver halide grains in an oxidizing environment to provide a photothermographic emulsion comprising chemically sensitized photosensitive silver halide grains in reactive association with said non-photosensitive source of reducible silver ions, and

30 (D) simultaneously with any of steps (A) through (C), or subsequent to (C), adding a binder to form a photothermographic emulsion formulation, and

(E) after step (D), coating and drying said photothermographic emulsion formulation on a support to provide a photothermographic imaging material.

5 24. The method of claim 23 wherein, simultaneously or subsequent to step (E), a protective overcoat formulation is coated over said photothermographic imaging layer.

10 25. The method of claim 23 wherein, prior to or simultaneously with step (E), a carrier layer is coated on said support underneath said photothermographic imaging layer.

15 26. The method of claim 23 further comprising coating a layer on a non-imaging side of said support.

27. The method of claim 26 wherein said layer coated on said non-imaging side is a conductive layer.